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HARVEY AND HIS DISCOVERY:

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BY

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PREFACE.

THIS little volume consists of an address delivered on Harvey at the opening of the session of the Jefferson Medical College, with some illustrative notes. In studying the life of Harvey I have availed myself of the usual sources to which every one interested in him turns, such as the scholarly translation of his works by Dr. Robert Willis, published by the Sydenham Society, and the life prefixed to it, the edition of his works issued by the London College of Physicians with the biography of Lawrence, and Aubrey's Letters. Besides these, I have made use of many isolated facts contained in numerous Harveian Orations, and of the recently-published Reports of the Commission on Historical Manuscripts, which contain a number of references to Harvey. But the most valuable part of my material has come from the close examination of the works of the great discoverer himself, for scattered through them, in prefaces, in notes, and in the text, is much that shows his manner of thought, his feelings, even his moods. I trust that this contribution to the study of the character of so famous a man may not be without interest to the admirers of his genius.

1700 Walnut Street, October, 1878.

HARVEY AND HIS DISCOVERY.

TIME has brought me the occasion of addressing you at this gathering of professional men, and as I look at old friends or at the comrades who for the first time sit beside them, I am conscious how pleasant a duty it is to welcome all, on behalf of my colleagues and myself, to these halls. It is customary with the words of welcome to mingle words of advice and cheer,—words to tell you how your profession is to be studied, and how you are to benefit by your opportunities,—words to make you more than ever anxious to excel in the task you have undertaken, and more than ever proud of being workers in such a noble cause. But I trust you will pardon me if I do not tread this path. It would lead to nothing which has not been far better and more eloquently pointed out than I can hope to do. Let me rather attempt to show you what example and precept you may find in the history of a most distinguished member of our calling. This year is the tercentenary of the birth of Harvey, and while in the land that claims him as a great son fresh honor is being done

to his memory, we his children in science, and speaking the same language, may reverence him by reading in his life the lessons of great achievements, and of devotion and purity, which we may humbly try to imitate.

In 1597 a young man of nineteen, described on the College Register as *Gul. Harvey, filius Thomæ Harvey, Yeoman Cantianus*, left Gonville-Caius College, Cambridge, with the purpose of becoming a physician. The youthful Bachelor of Arts, well trained in the classics and in mathematics, was anxious to avail himself of the best opportunities of studying medicine, and as at that time the schools of Italy had the highest reputation, he went thither, and selected Padua, influenced, perhaps, by the benefactor of his own college, Dr. Cajus, having once lectured there. That great university, which had done so much to quicken the intellectual life of Europe, that university to which to this day Italy points with pride as having been at one time a commonwealth of learning with eighteen thousand students, was not then quite as flourishing in numbers. But its old reputation was scarcely dimmed; and when Harvey joined the crowd which always, in October, on St. Luke's Day, assembled, at the beginning of the medical session, in the church to listen to a discourse by some doctor of the university or other learned man, in honor of the pursuit of medicine, and urging its diligent study,—we see how venerable an institution an introductory lecture is, and what a very respectable lineage it may trace,—he must have

done so with the consciousness that he was on hallowed ground.

We soon find Harvey busily at work in this great republic of letters, attending the lectures of celebrated teachers, as of Casserius and Fabricius. In the anatomical theatre of this noted anatomist he was so constantly that the dear old man conceived a warm friendship for him. Perhaps the renowned professor may have had some glimmerings that in training this brilliant pupil he was fashioning for himself a monument more lasting even than his own famed works.

At the university Harvey spent nearly five years, and the quick-tempered, manly little man was a great favorite, particularly with his own countrymen. Willoughby, Matthew Lister, Maunsell, Fox, were his intimate friends.* The celebrated Caspar Hofmann, to whom he in after-years addressed so memorable a letter, was among his fellow-students. But whether mere acquaintances or friends, all must have rejoiced when they accompanied him to obtain his diploma, which speaks in language of extraordinary praise of his clear and excellent answers, and how admirably he had conducted himself, and what powers of mind and memory he had shown.† We can almost see him before us now, the active lithe young man, with his

* C. West's *Harveian Oration*, 1874.

† In the Latin edition of Harvey's works edited by the College of Physicians in 1776, the diploma is given in full. It is signed by Fabricius, Professor of Anatomy; Minadous and Raguseus Venetus, Professors of Medicine; Casserius, Professor of Surgery.

round face, his long, dark beard, his flashing black eyes, his highly intellectual expression. We can see him receiving the congratulations of his friends, exchanging jests with them, and going off to make a merry ending to the ceremonies. Nor is it unlikely that many were the remarks at the convivial meeting as to how difficult was the thesis which had to be sustained, and how stern Casserius and Minadous were in asking such hard questions, with many a half-expressed hope that when it came to the turn of the jovial sympathizers the learned professors might be less like ogres.

Harvey returned to England in 1602, and went back to Cambridge for a time to receive the doctor's degree of his old university. But we soon find him settled in London, anxious to enter on practice. He married not long afterwards, taking as wife the daughter of a very prominent medical personage, Dr. Lancelot Browne, physician to Queen Elizabeth. In 1604 he became a candidate for fellowship in the College of Physicians, and three years afterwards he was elected a Fellow. During this, the early period of his professional career, we have no record of him. Not even the tattling Aubrey,* to whom we owe most of what little we know of Harvey's private life, tells us anything. But it must have been the history of every struggling medical man who has risen to eminence. The same doing of good without hope of reward; the same hours, days, years of weary waiting; the same exalt-

* *Letters and Lives of Eminent Men*, vol. ii.

ation over successes; the same depression over failures; the same wondering whether prosperity is ever to come; the same steady preparation for it by untiring industry, by never-flagging interest; the same burning enthusiasm in making researches which slowly lead to fame, and which have trained the mind to profit by the largest opportunities growing fame may bring;—these in the seventeenth century, as now, filled up the years of waiting of the future master of his profession.

One of the trials of this time of probation Harvey had not to encounter. To the poverty which most of those who have risen have also had to overcome, he was a stranger. His family was wealthy; his brothers were prosperous and prominent merchants, anxious to assist him in every way. It is likely, too, that being to a great extent independent, he mixed in the world, making friends, who afterwards aided him in his career; that, when tired of hard work, he frequented the coffee-houses just then coming into vogue, and to which nearly every one of prominence repaired, or sat on the boards of those rudely constructed open theatres, where all the fashion and literature of the day used to meet and gossip.

In 1609, Harvey, then in his thirty-second year, was elected physician to St. Bartholomew's Hospital. He had previously secured, according to the custom of his times, the reversion to the post, and in so doing had procured letters in his behalf from the King, and many testimonials of competency. The hospital appointment brought him prominently before the public, and from the period it

was given to him he rose into a large practice. But we must not suppose that a hospital furnished then, as it does now, rare opportunities for the extension of knowledge, or that the results obtained were very satisfactory. The arrangements were bad, the ventilation shocking. Most hospitals were but rough buildings, generally with wards clustered around a chapel, and without the least attention to hygienic necessities. There were, it is true, some great and tolerably well built hospitals, as that of Milan, which Harvey must have seen in his Italian travels. The hospital to which he became attached was very small, more like a dispensary than a hospital; and it does not appear to have been overstocked with patients, or to have been a tax on his time. In the letter appointing him he is charged to exert himself in the cause of the poor according to his best knowledge.*

* This and other interesting documents bearing on Harvey's connection with St. Bartholomew's Hospital have been collected and published by James Paget, Esq., London, 1846. We may learn from the letter what the duties of a physician were:

“PHISICON:

“You are here elected and admitted to be the Phisicon for the Poore of this hospitall, to p'forme the chardge followinge, That is to say, one day in the weeke at the leaste thorough the yeare, or oftner as neede shall requyer you shall come to this Hospitall, and cause the Hospitler, Matron, or Porter, to call before you in the hall of this hospitall such and soe many of the poore harboured in this hospitall, as shall neede counsel & advise of the phisicon. And you are here requyred & desyred by us, in God his most holly name, that you endeavour yourselfe to doe the beste

It was customary for the physicians to reside in the institution, although Harvey never did so. He received a certain allowance or right in property belonging to the Hospital, in commutation of house-rent. But it does not appear that he ever accepted anything in place of the gorgeous suit of clothes or "livery" of costly material which the Governors provided for the medical officers.

(It seems strange to us, with our knowledge of what hospital physicians do, to find that it was no part of his duty, except in cases of emergency or under very unusual circumstances, to visit a patient in the wards. In truth, the chief service of the physician was to give advice in such instances as the surgeons brought to his notice, and to superintend the surgeons generally, whose duties were not limited, however, to surgical cases. It is evident
 x that the surgeons were in those days regarded as very inferior to the physicians; and an amusing illustration of this remains in the rules which Harvey, who was greatly

of your knowledge in the profession of phisicke to the poore then ^{present} p'sente, or any other of the poore at any tyme in the weeke wth shalbe sent home unto you by the Hospitler or Matron for your counsell, wrytinge in a booke appoynted for that purpose, such medicines with theire compounds and necessaires as ^{apperteyneth} apperteyneth to the apothecary of this house, to be provyded and made reddey for to be ministred unto the poore, every one in p'ticular acordinge to his disease. You shall not for favour, lucre or gaine, appoynte or write any thing for the poore, but such good and wholesome things as you shall thinke wth your best advise will doe the poore good, without any affecon or respecte to be had to the apothecary. And you shall take noe gifte or reward of any of the poore of this house for your counsell." . . .

esteemed by the Governors of the Hospital and constantly consulted by them, drew up for its management.

Here are some of them :

8. That the chirurgions in all difficult cases, or where inward phisick ^{treatment} may be necessary, shall consult with the Do^r at the tymes he sitteth once in the weeke, and then the M^r [Master in Surgery ?] himselfe relate to the Do^r what he conceaveth of the cure & what he hath done therein, And in a decent & orderly manner p^rceed by the do^r's dirrecons for the good of the poore and credit of the howse.

Agreed unto.

10. That no Chirurgion or his man practize by giveinge inward phisick to the poore, w^hout th' app^rbacon of the Do^r.

Allowed.

12. That ev^ry chirurgion shall shewe & declare unto the Do^r, whensoever he shall in the p^rsence of the patient require him, what he findeth, & what he useth to ev^ry externall malady ; that soe the Do^r beinge informed may better w^h judgm^t order his p^rscripts.

The Chirurgions p^rtest against this.

Yes ; and although the surgical staff at the time contained one man of real eminence, John Woodhall, the most distinguished naval surgeon of his day, and one who, by teaching us how to prevent scurvy, has saved countless lives and made successes in commerce and in war attainable which would have been otherwise impossible, popular opinion supported the physicians ; and the predecessors of the Hunters, the Coopers, the Brodies, the Pagets, were actually liable to prosecution and fine for endeavoring to counteract disease with internal means.

The surgeons at St. Bartholomew's had then not an easy berth of it. Even their salaries were smaller than they would probably have received in consequence of special appointments,—as of the Surgeon for the Stone and Ruptures, and of the Bonesetter. And we have traces of a woman surgeon, who, at least financially, seems to have had altogether the best of the positions,—the curer of Scald Heads. At first scald heads seemed to be few, and we find her receiving only a small sum for each head, then comes a bill in which there is also a charge for earnest-money to amend another scald head, and finally the curer of scald heads is shaped into a permanent and lucrative appointment. One Frances Holcombe, a widow, was so zealous in the performance of her duties and so thrifty that she became quite an heiress, and, dropping her widow's weeds, devoted herself with augmented energy to scald heads. Her annual income steadily increased until it rose in 1635, for the curing of scald heads alone, to £125. The eight or ten beadles who, in accordance with the charter of the hospital, were employed to seek out the poor and the sick and to bring them to the Hospital, must have spent most of their time in running after and securing the scald heads of all London to please the buxom practitioner.

Harvey was for a long time connected with St. Bartholomew's, and the interest he took in it, and his popularity and renown, were such that, notwithstanding his protracted absences with the King and the urging of a hostile Parliament, the Governors were unwilling to let

him sever his connection with the Hospital. Well may this splendid institution, which has done so much for medical science and medical teaching, be proud that it carried on its register for thirty-four years the great name of Harvey.

Yet, however much a matter of interest may have been the Hospital to Harvey, we find in his work but few traces of its having been a source of inducement to exertion. Indeed, it was not from his hospital connection, nor, it must be added, from association with the colleagues with whom he was thrown in daily professional contact, that Harvey got his desire for scientific knowledge. There were in the English profession at that time but few men who towered above the rest, and none who were likely by example to stimulate the active intellect of Harvey. He was rather moved to restless study by the times in which he lived, and the influence which the very atmosphere he breathed with the great thinkers and discoverers exerted on his impressionable mind. To have seen all traditions broken and a new world of feeling, of imagery, of passion, of truths half obscure, illuminated by the genius of Shakespeare; to have been profoundly stirred by the majestic verse and magnificent prose of Milton; to have felt the astonishment with which Napier's logarithms were received; to have talked with Cowley or jested with Ben Jonson; to have as an intimate enjoyed the wit of Bacon, and been keenly conscious of his lofty aims; to have argued with Hobbes and Boyle, and discussed with them of cotemporaries of immortal fame

in other lands, of Kepler, of Descartes, of Galileo, of Spinoza; to have witnessed the fierce struggle between King and people, between half-upheld, perfidious prerogative, and ungovernable, aggressive liberty, and seen that struggle bent to selfish purposes by the greatest ruler England has ever known; to have felt the popular mind quickening to questions of religion, and filled with interest in religious thought as it had rarely been before; to have shared the emotion with which the translation of the Bible was received, and which must have revealed to him, scholar as he was, a loftiness and dignity in his own mother tongue that he had not dreamed of;—to have lived among these influences, and in them, was certain to have exalted Harvey's bright mind and to have kept it ever active.

One of the earliest public proofs we have of Harvey's kindled love of research is seen when he was chosen to deliver the Lumleian Lectures on Anatomy and Surgery at the College of Physicians. He began in the very first course he gave, in 1616, to discuss the circulation of the blood, and startled his hearers by announcing his original views. He had evidently been studying the subject with great care for some time. Yet it was not until after many a course of lectures, and many additional experiments and illustrations, that he published, in 1628, his treatise on the Motion of the Heart and Blood containing his remarkable discovery. In our day such procedure would not be possible. He could not have perfected his investigation first. Interviewers and reporters would have dogged his steps and made him say things of the truth

of which he was only half convinced, and which he would have liked to work out fully before giving them to the world as his convictions. Yes, we live in an age of great activity; and the green fruit must go to market with the ripe.

The fame of Harvey's lectures and his prominence as a physician coming to the notice of James, Harvey was appointed in 1623 physician extraordinary to the King, with the reversion to the place of physician in ordinary when it should become vacant, which it did not until some years after Charles I. had ascended the throne. To Charles's Court Harvey was in truth the trusted physician; and he seems to have been consulted by very many of the prominent persons of the day. Aubrey, indeed, informs us that the sensation made by his book on the circulation was injurious to his reputation as a physician, "that he fell mightily in his practice; and 'twas believed by the vulgar that he was crack-brained; and all the physitians were against his opinion." And the same authority tells us that "all his profession would allowe him to be an excellent anatomist, but I never heard any that admired his therapeutique way. I knew several practitioners in this towne [London] that would not have given 3*d.* for one of his bills,* and that a man could hardly tell by one of his bills what he did aime at." But if these statements were true, they were so only for a short period. The number of distinguished men he attended, the warm man-

* Prescriptions.

ner in which his professional brethren in England took up his claims, the respect they paid to him and to his opinions on all occasions, his selection by the King to travel with the Duke of Lennox, his promotion on his return to physician in ordinary to the royal household, attest the repute in which his skill was held. His practice, in truth, seems gradually to have been contracted by himself, in order to have the more leisure for his favorite pursuits. It was also lessened by the protracted absences on the Continent, for besides his accompanying the Duke of Lennox, he was attached to the extraordinary embassy of the Earl of Arundel, sent to the Imperial Court at Vienna. But it was, after all, his customary duties at Court which chiefly stopped his career as a physician of extensive practice; for wherever the King went he was obliged to accompany him, and the King often took long journeys. In some respects this was of great use to Harvey. It brought him in contact with many medical and scientific men, and the fame of the new doctrine and the interest in it were largely increased by the demonstrations he was always willing to make. Otherwise Harvey's connection with the Court was not beneficial; and he does not show to advantage in the elegant graces of the courtier. The dedication of his famous book to Charles, in which he reminds his most illustrious Prince that "as the heart of animals is the foundation of their life, the sovereign of everything within them, the sun of their microcosm, that upon which all growth depends, from which all power proceeds; the King in like manner is the foundation of his kingdom, the sun

cine led to his becoming later in life a Fellow of the College of Physicians, and its munificent benefactor. Thus

"Many a baron bold,
And gorgeous dames, and statesmen old,"

came into Harvey's laboratory: and to all this great world, whether mere curiosity-seekers or actually interested in science, he exhibited the mysteries of the circulation.

Yet in point of fact, as he tells us himself, the observations the King and the Court delighted in were connected with his inquiries into generation. The King had allowed him the freest use of the royal herds of deer, and he demonstrated to "his serene highness" the *punctum saliens*, which, with the advantage of the sun's light falling on it, had become "beautifully distinct;"* or when he came across "a very small egg covered with a shell, contained within another larger egg, perfect in all respects and completely surrounded with a shell," he forthwith sought out his Majesty and showed him the treasure in the presence of many persons.† But the King's interest did not end with these physiological researches. When it was noised about at Court that a young nobleman had, in consequence of a severe fall, an immense gap in the side, through which, as it was thought, the lungs could be touched, the King sent Harvey to him with the royal commands to lay open his side for inspection. To Harvey's delight, it was the heart,

* On Generation. Harvey's Works. Sydenham Society Edition, p. 485.

† *Ibid.*, p. 206

not the lung, that was exposed, and he found the heart to be insensible. "Instead of a verbal answer, therefore, I carried the young man himself to the King, that his Majesty might with his own eyes behold this wonderful case that, in a man alive and well, he might, without detriment to the individual, observe the movement of the heart, and with his proper hand even touch the ventricles as they contracted."* The two evidently studied the case together with much care, and his most excellent Majesty "acknowledged that the heart was without the sense of touch."

It was in one of the journeys that Harvey took through his connection with the Court—the one in which he accompanied the Earl of Arundel—that he is reported to have made, at Nuremberg, a demonstration of the anatomical facts underlying his discovery, at which a bitter opponent of his doctrine, the learned Caspar Hofmann, is said to have been present. This was in 1636, eight years, therefore, after he had given his views to the world in his treatise, and when he had been fiercely assailed for them. But it must be added that no one was more capable of defending himself than Harvey when he chose to contend. In most of the notices of his life he is represented as a meek, placid kind of man, who allowed any and every one to attack him, and who bore even insults most quietly. This is quite erroneous. It is true he did not often take the trouble to retort; but he was a man of high spirit, and

* On Generation. Harvey's Works. Sydenham Society Edition, p. 383.

When he did speak, he spoke with rightful indignation. He turned to Hofmann, who at first would not come and would not see, and then would not be convinced, has the right thing. It tells him, if you care not to come and see with your own eyes what shall be shown you, and if you do not wish to investigate the subject for yourself, "let me beseech you, I say, not to vilify the industry of others, nor charge it to them as a crime; do not derogate from the character of an honest man, not altogether foolish nor insane, who has had experience in such matters for a long series of years. Farewell, and beware! and act by me as I have acted by you." . . .

Here is the investigator tired of arguing with the learned expert. Here is genius flashing out with the lofty consciousness of wisdom. Here is the knight aware of his strength buckling on his armor, and ringing out the silver trumpet tones of truth in defiance to conceit, arrogance, and dulness.

Harvey's connection with the Court was to prove to him a source of great perplexity and trouble. He became involved in all the changing fortunes of Charles. He saw the conflict between King and Parliament break out into open war; and he took the field with the King to care for his person, at first, strange to say, by the command of Parliament. While following the royal standard, he was present at the battle of Edgehill, and such was the confidence in him, that the King's young sons, Prince Charles and the Duke of York, were placed under his care. As an instance of his indifference to everything except his

own pursuits, Aubrey* tells us that he withdrew with his charge under a hedge, "and tooke out of his pocket a booke and read. But he had not read very long before a bullet of a great gun grazed on the ground neare him, which made him remove his station." If this story be exactly as it is given, it bears, I think, a different meaning from that in which it has been accepted. Not to speak of the close ties which bound Harvey to the King, a man of his temperament, quick, nervous, choleric, prone in his youth on the slightest provocation to unsheath his dagger, could not have been present at a battle on which so much depended without the deepest interest in its varying fortunes. He could not have stood unmoved and witnessed Rupert's impetuous charge and headlong pursuit, or Aston's dragons in gallant emulation breaking through long lines of musketeers to rout the opposing horse; he could not later in the day have seen without alarm the King and his immediate followers surrounded and nearly prisoners; nor gazed without a beating heart at the sullen, almost unmo-lested retreat of Essex's broken but undaunted pikemen. No, if Harvey acted as he has been said to have acted, he did so because he wished to give confidence to the young Princes and to impart to them his own coolness.

The battle of Edgehill was followed by the occupation on the part of the royal troops of Oxford, which became the chief residence of the King for several years. Harvey in consequence made Oxford his home. He was soon again at work at his scientific pursuits, at work with fresh

* Vol. ii. p. 379.

observations and reflections on his doctrine of the circulation, but especially and eagerly with his researches on generation. It was during the King's occupation that the society destined to become so famous, the Royal Society, originated, and Harvey was among those who had a large share in laying its foundation. His renown was now so great and he was held in such high esteem, that when the wardenship of Merton's College became vacant, he was, in 1645, appointed to it. But he did not hold this honored position long. Oxford surrendered to the Parliamentary forces the next year, and the former warden was reinstated. Harvey returned to London.

A complete change now took place in his life. He was sixty-eight years of age, and felt himself unable to bear the life of excitement and fatigue to which in those stormy times he was as Court physician doomed. He withdrew from the service, with undiminished love, however, for the King who had always treated him so well.* One

* Yet he does not appear to have abandoned at once his care of the King's person, nor his function as his physician. This is learnt from recently published documents, from an extract from the Sixth Report of the Royal Commission on Historical Manuscripts (London, 1877), page 142:

"Calendar of manuscripts of the House of Lords, 1646, November 24. Petition of William Harvey, doctor of physic, and one of His Majesty's principal physicians in ordinary. Petitioner has for many years attended His Majesty, and is desirous to continue his attendance, especially as he understands that there is no one (sworn in ordinary) now with His Majesty. He prays for a pass for himself, with three servants and four horses, to go to Newcastle or elsewhere to attend His Majesty, and to return as his service shall require. [Cf.] Lords' Journals, viii. 577."

great misfortune befell him just prior to his leaving the Court. His papers, with his furniture, at his London house were ruthlessly seized and scattered or burned by a Puritan mob, and many of his long researches thus sacrificed. Among these papers, it is stated, were his "Medical Observations," to which he refers in his second letter to Riolan, and which were to contain full records of his investigations on disease in the living and the dead; records, therefore, which would have advanced the science of Pathology by more than a generation.

In returning to London, Harvey did not go back to a dwelling of his own. He lived with those beloved brothers to whom through his whole life he was so tenderly attached; especially with his brother Eliab, who seems to have taken excellent care alike of him and of his worldly affairs. In each of the brother's houses, whether in the town or in the country, Harvey had his apartments, and wherever he is we find him busily occupied with his researches. He attended also to the practice of his profession, yet not much, and chiefly among his friends, or when consulted by persons of eminence on account of his great name. We may get some idea of how active he was at times as a practitioner, how inactive at others, from a manuscript still preserved in the Sloane collection of the British Museum (No. 1055), containing the names of, and prescriptions for, many of his patients between the years 1638 and 1651. Unfortunately, its authenticity has been doubted; at all events, it has been questioned whether it entirely emanated from him, chiefly on the ground that

the writing is very legible; for the great doctor had the classical failing of doctors, he wrote a very bad hand. Another manuscript, the one containing the long-lost notes of his early lectures, and also belonging to the Sloane collection, was last year discovered,* and the writing is such a puzzle that everybody admits that it is Harvey's. This manuscript proves what has been often commented on, that when merely making notes he was in the habit of jumbling up words in different languages. An important physiological fact is thus stated in some reflections on the heart: "*Exempto corde, frogg scipp, eel crawle, dogg ambulat.*"

In the comparative retirement in which Harvey passed the latter part of his life he busied himself with his work on Animal Generation. This was published in 1651, when he was seventy-three years of age, at the solicitation of his friend, Dr. Ent. At first he was unwilling to part with his manuscript. But no matter how coy an author, he ends usually by yielding, and so Harvey yielded, notwithstanding his protest, that it is much better to grow wise at home and in private "than by publishing what you have amassed with infinite labor, to stir up tempests that may rob you of peace and quiet for the rest of your days."† The accomplished scholar, who likens himself to Jason laden with the golden fleece, hurried away with his treasure, and evidently corrected it with much care for the press. This great work, though of necessity in-

* Sieveking, Med. Times and Gazette, July, 1877.

† Ent's epistolary Dedication to Anatomical Exercises on the Generation of Animals.

ferior to his first, added to Harvey's reputation, and the College of Physicians, proud of the fame of their illustrious member, placed his statue in their hall. He was as much attached to his colleagues as they were to him, and at his own expense he erected a splendid building as an addition to the College, in part of which there was a museum and library, which he furnished with preparations and books. He furthermore settled a sum as a salary for the librarian; and another for the delivery of an annual oration, the object of which was to exhort the Fellows to mutual love and affection, to commemorate benefactors of the College and to instigate new ones, and to search out the secrets of nature. He also provided for a general feast, to be held the same day as the oration, within the walls of the College for all Fellows that should please to come. The feast, true to the spirit of our times, has passed into a *conversazione*. The building, with its contents, perished in the great fire of London. The other gift survives as started, and the Harveian Oration has become a yearly contribution to the literature of the profession. The first was delivered in 1656. Since that time there have been many Harveian Orations which laud the benefactors of the College, and especially the great Harvey,—it must be confessed that the temptation to do so is almost irresistible,—but not so many as he would have desired in which we find him obeyed, “to search and study out the secrets of nature by way of experiment.” Yet scholarly and meritorious they all have been; and Meade and Arbuthnot, Akenside, Halford, Latham, and, in our own day,

who sat in the Little Parliament as the sole representative of the University of Oxford; Micklethwaite, the charitable, the pious, and the doctor of admirable judgment; Edward Alston, the shrewd, wealthy treasurer of the College; Glisson, the anatomy-reader of the College, who had just published his famous work on the Liver,—a great anatomist, incited by Harvey's example; Peter Chamberlen, renowned as a practitioner, and reputed so skilful in midwifery that King Charles would pay no heed to the autograph letter of the Czar that he might be allowed to enter his service; Mayerne, the polished old courtier, who has left us a most amusing work on the duties of a fashionable physician; Winston, the learned, venerable Gresham professor, caustic of wit, recently returned after a ten years' absence in France, made necessary by having offended Parliament; Laune, the man of many disappointments, always seeking, never obtaining, and who, when he did succeed, as a septuagenarian, in being appointed Physician to the Fleet, perished at sea in his first cruise; Hamey, the newly elected Censor of the College, in the love and munificence towards which he rivalled Harvey, a staunch Royalist, sometimes thinking it necessary to disarm suspicion by going to hear a barber or peddler hold forth, but preventing his cultured ears from being outraged by becoming absorbed in an Aldus edition of Virgil, bound to resemble an octavo Bible; Ent, the scholar of extensive acquirements, the knight ever willing to fight his great chief's battles; Coxe, like Ent, a Master of Arts of Cambridge, much honored by his colleagues, already a Censor of the

stated. It must indeed have been a signal occasion when Harvey refused a post considered the most desirable in the profession. There stands the old man with snow-white head, with the broad forehead and intellectual look with which Jansen's canvas has made us so familiar; there he stands, his eye full of its old fire, his gestures rapid. As he begins to speak, the periwigs cease wagging, the gold-headed canes are more firmly grasped, the gentle ripple of professional gossip is hushed; all is attention, respect. Around him, in the spacious hall which his munificence has created, are gathered nearly all the distinguished men in the English profession. In his audience are Scarborough, his loving friend, the soldier, the elegant scholar, the philosopher as well as physician, the possessor of the finest collection of mathematical books of his day in Europe; Wharton, the philanthropist, who, when even the doctors left plague-stricken London, stayed to attend to his patients and the poor; Merrett, learned, accomplished, the one to whose charge the Harveian Library and Museum was confided from the beginning, a position which seemed to insure an easy lettered life, but which involved him ultimately in lawsuit and disgrace; Emily,* the first Harveian orator, whose indiscreet criticism on army and government gave great offence to the all-powerful Lord Protector; Bathurst, the friend and physician of Cromwell; Goddard, also a favorite of his, whom he had appointed Warden of Merton College, and

* Munk, Roll of the Royal College of Physicians of London.

rid of it he pursued a very risky treatment, which, however, he found speedily effectual,—he exposed the whole body to the cold air, even in winter, and placed the swollen foot in cold water until he was benumbed with cold. He evidently was a great believer in cold air, for when affected with sleeplessness he rose from his bed, walked about his chamber in his shirt until he was quite cool, and then returned to bed to sleep comfortably. He delighted in being in the dark, for, as he told Aubrey, he could then best contemplate. At his home at Combe, in Surrey, he had caves made in the earth, to which in summer-time he often retired for meditation. He was a man of most liberal culture, a great student of philosophy, an excellent Latin scholar, a faithful lover of the classics. Virgil was his favorite author, and he seems to have shared the mediæval idea of the poet being a sorcerer, for he often threw away the book exclaiming that he was a wizard or “had a devil.”* But the great physician had many pursuits. Aubrey found him, not long before his death even, working at a problem from Oughtred’s “*Clavis Mathematica*,” which was always in his study.

Harvey was a man of the finest imagination, and he kept that imagination bright by his mental habits. There was nothing in him of the Gradgrind, and he would have made but a sorry statistician. He threw his intense and glowing mind into all his work.

“*Spiritus intus alit, totamque infusa per artus
Mens agitat molem,*”

* Sir William Temple, *Miscellanies*, Part ii., on Poetry.

from his favorite bard, might well be applied to everything that he labored at. The result was that he produced work penetrated with thought and compressed by his trained intellect and fine literary faculty into convincing argument.

He was not only a great anatomist, a great physiologist, a great thinker and ingenious experimenter, he was also a great teacher, very communicative and willing to instruct, and he became a favorite with the young, who aided him enthusiastically in his researches. Yet with all his fine faculties he was not entirely above the credulity so common to his age. He believed in a race of human beings in Borneo with tails, and he attributed the dispersion of certain tumors to the application of the hand of a corpse.*

Harvey was more than a keen observer of natural phenomena, he was an ardent admirer of Nature, deeply imbued with religious sentiment, and constantly alluding to the Supreme Intelligence perceptible in Nature's works. Of his affectionate disposition, his generosity, his thoughtfulness to his dependants, there are abundant proofs; the manner in which many of them are remembered in his will attests his kindness.

He was very fond of animals, and gives in his work on *Generation* a long account of the habits of a pet parrot, which, seized with repeated attacks of convulsions, expired "deeply regretted."†

* Quoted by Guy, in his *Harveian Oration*, from Boyle's works, vols. ii. and v.

† Page 187, Sydenham Society Edition.

He lived in the style that befitted a man of his position. In visiting his patients he rode on horseback, "with a foot-cloath, his man following on foot, as the fashion then was, which was very decent, now quite discontinued," says Aubrey, lamentingly. Of his domestic affairs nothing is known. He was childless, and probably long outlived his wife.

In his personal habits Harvey was very simple. He was extremely fond of coffee, and made a special bequest of his coffee-pot in his will. Bishop Duppa writes that when he was an old man he would fast for two days together.*

He had not formed during his long life a very favorable opinion of mankind. He was in the habit of saying that "man was but a great mischievous baboon," and it is to be feared his opinion of women was not more favorable; for he told Aubrey that "we Europeans know not how to order or govern our women, and that the Turks are the only people who used them wisely."

Harvey died of apoplexy on the 3d of June, 1657, in the eightieth year of his life. From the symptoms I judge that the attack was apoplexy with aphasia; it was but of short duration. His body was followed to the grave by his many relatives and by hosts of friends. He was interred at Hempstead Church, in the vault of his brother Eliab, the brother to whom he seems to have been

* Letter of Bishop Duppa, Bishop of Salisbury, July 8, 1660, Royal Histor. Manusc. Commission, Appendix to 3d Report, p. 254.

the most attached, and to whom he left the bulk of his large fortune. His colleagues of the College of Physicians mourned him deeply. They had revered him not simply because he was great and famous, but because he was honest in intent, fair-minded and generous to them, and wholly devoted to that science of which he became one of the most illustrious followers of any age or country. To his portrait and bust in the College they subsequently attached a very long inscription;* it seemed they could not say enough in commemoration of his achievements and virtues; and mankind has not disputed their opinion, it has not changed the judgment cut into the stone.

From Harvey the man we turn to Harvey the discoverer. His great discovery, as all the world knows, is the circulation of the blood. The manner of that discovery forms a landmark in the history of human thought. It is a splendid proof of the power of correct reasoning upon facts determined by observation of nature and by experiment. To understand its merit we must think of the state of knowledge concerning the heart and blood-vessels which existed when Harvey began his labors. The motion and uses of the heart were completely misunderstood. The most advanced knowledge connected its movements

* The inscription is printed in full in the Life prefixed to the translation of Harvey's Works by Dr. Robert Willis, issued by the Sydenham Society.

with the passage of the blood to the lungs. But not all the blood went to the lungs, much remained in the venous system and the right ventricle; a portion, as Galen had taught, found its way, through pores or foramina in the septum of the heart, from the right to the left side. It became there admixed with the blood which had come down from the lungs through the pulmonary veins, and with air and spirits or vapors which these transmitted to vivify the blood. A part of this vivified blood, such at least was the current opinion, passed back to the lungs through the pulmonary veins. The function of the pulmonary artery was to nourish the lungs. The heart was known to beat, but its beat effected nothing; the veins were held to be full of blood, and to originate chiefly in the liver; the arteries were supposed to enclose aerated blood, air, and vital spirits, their special office being to convey these spirits. The blood was chiefly contained in the veins. It was, according to the prevailing sentiment, not motionless in the vessels; it moved up and down as by an ebbing and flowing tide, particularly in the veins. The properties of the arterial blood and the vital spirits in the arteries might be communicated through the ultimate ramifications of the arteries to the veins, but the blood itself did not pass. There were then really two almost separate kinds of blood, each within its own system.

When Harvey, familiar with the confusing views of the day, began by actual inspection to study the subject, and commenced with an investigation of the motions of the heart, he found the task so difficult that he was "almost

tempted to think, with Fracastorius, that the motion of the heart was only to be comprehended by God." Gradually, by recourse to vivisection, and by collating numerous observations, he gets clear knowledge. He finds, contrary to the opinions commonly received, that the heart when it contracts is emptied. He sees that as it becomes tense the blood is expelled; he observes that as it relaxes it receives blood. Every time the heart contracts the pulse is felt. When the right ventricle contracts and propels its charge of blood, the pulmonary artery is distended simultaneously with the other arteries of the body. He notices that the auricle on the right side of the heart contracts at the same time as that on the left, and that subsequently both ventricles contract. Why should both ventricles contract for the sole purpose of nourishing the lungs? asks his intelligence. It is against every evidence of design in nature to be so wasteful of structure and force. Why, too, is there a great artery taking its origin from the left heart? It can but be for the complete distribution of the blood to all parts of the body. Light has dawned. The heart is the propelling engine; the right ventricle is made for the sake of the lungs chiefly, the left for the general circulation. Good anatomist as he is, he knows that channels of communication between the right and left heart, through the heart-walls, are mere fanciful assumptions. He thinks of the valves of the heart, of the valves in the veins which his old teacher Fabricius has pointed out to him. He knows that an artery differs in the strength and thickness of its coats

from a vein. He finds evidence in all this of regulating flow, of preventing return, of sustaining the shock of the impelling heart and streaming blood. He makes experiments by tying the aorta at the base of the heart and opening the carotids; they are empty, the veins are full. The arteries receive, then, no blood except by transmission through the heart, is his conclusion. The left heart he has found gets its changed nutritive blood after the blood has passed through the lungs, "the workshop of its last perfection." This blood is thrown with each contraction of the left ventricle into the arterial system, and as the contractions are so frequent a large quantity is passed on in a short space of time. The veins would be drained; the ingested aliment could never rapidly and efficiently enough supply them with blood, which goes on so quickly into the arteries. These, strong as they are, would burst unless relieved. "There must be a motion, as it were, in a circle." The circulation is discovered. More experiments, more reasoning drawn from evidences of design, from pathological cases, more putting together of some observations and analyzing of others, only confirm and extend the induction. The old fabric of fanciful hypothesis has been shivered; a great, simple truth has been established.*

* Harvey notices an extraordinary number of facts in different animals in arriving at his conclusion, even the gradual development of the heart and the first appearance in the embryo of the "pulsating drop of blood" are made use of, and the heart-beat is studied in the shrimp. It is a pity in the light of what he himself narrates to spoil the story told in Newnham's

Such are some of the chief ideas and facts which guided Harvey in his endeavors to solve the difficult problem. And when he had finally completed the subject, he gave his conclusions and his reasons to the world in a treatise of only fifty pages; but a treatise so full of sound logic, of simple yet effective experiment, of brilliant induction, such a model of scientific exposition, in language and style, that the fame of being the author of "*Exercitatio Anatomica de Motu Cordis et Sanguinis*" is only eclipsed by the fame of being the originator of the doctrine it sets forth. Here, then, was no chance discovery. Harvey's gaze was for a long time riveted on one of Nature's secrets, and he finally discerned it; he sought patiently, and he found what he sought. And when he found, all seemed so plain and obvious. In his massive work we scarcely detect the long, laborious preparation, and how completely the reward was the result of his full faculties. The oak had grown into the noble tree from its spreading roots. We admire its strength and stately proportions; the manifold forces from which its growth springs lie hidden away, branched out in all directions.

The discovery of Harvey met with the fate of most discoveries. There are always those to whom it is unpleasant to be disturbed in their beliefs or in what they

"*Essay on Man*," p. 71. "This discovery, *i.e.*, the circulation of the blood, in 1620, is attributable to our countryman Harvey, ascertained by experiments on a dog, whose name, Lycisca, and whose sufferings and whose usefulness to mankind have been immortalized and handed down to posterity in some beautiful, touching lines."

have learned with toil, who, not wishing to unlearn, resent a discovery as a personal injury. There are those who cannot conceive how any one can find what they have not been able to detect. Both these classes opposed of course Harvey's discovery. They opposed it with perverse statement of facts, with bad temper, with bad logic. Of most notoriety among these obstructives was Riolan, whom Harvey answered in two letters, which form valuable appendices to his great treatise. Most offensive among them was Primerose, who in language as odious as his doubts attacked what he had not the intelligence to understand. But if there were enemies, there were soon also warm friends,—Regius, Rolfink, Ent, Pecquet, and one whom it was a glory to have enlisted on his side, the illustrious Descartes. Another strong ally was Plempius, to whose credit be it said that he convinced himself of the truth of the new doctrine while attempting to refute it, and, acknowledging his error, at once enrolled himself manfully among the promulgators of the truth.

The knowledge of the discovery spread rapidly from place of learning to place of learning, and, notwithstanding the opposition to his views at first, Harvey had the satisfaction of seeing them almost universally acknowledged and taught. Hobbes says, in his preface to his "*Elements of Philosophy*," that Harvey was the only man he had known who lived to witness a new doctrine he had promulgated established. This statement may have applied to those times; it would not apply to ours.

The indisposition to receive the new is, in fact, disap-

pearing from among us very fast, and the period of probation for valuable discoveries is becoming shorter and shorter. What is true is sure of speedy acceptance; and if after a lapse of years, not now a long one, a fact generally disseminated or a system keenly discussed is rejected by those qualified to judge, it is because it is false. There is for matters intellectual and for facts scientific a statute of limitation framed by the cultivated; that which is outside the statute becomes pseudo-science and unfounded assertion. We find this in all the so-called exclusive systems in medicine. We know that they are not true, because they have been so long before us, and are so universally rejected by those best fitted to pronounce judgment. If true, like the startling innovation of Harvey, they would long since have made their way in the profession. One generation might have ignored or opposed them; but the young of that generation would have discussed them and leaned towards them. One generation might have hesitated, the next would have warmly adopted them. Did not Jenner live to see vaccination ardently approved of in the four quarters of the globe? Have not anæsthetics, has not the hypodermic method, rapidly overcome every opposition? Were the great discoveries of Bernard—of all of our day the one whose work Harvey would most have delighted in—were they long before us before they were enthusiastically incorporated in our science? No; so eager are we after the truth; so keenly conscious that we have to contend with a foe from whom we can expect nothing, and with whom we can entertain no conditions of peace;

versy of the unknown assistant who always does the work and really deserves all the credit; of the one who, as captain on the staff of Grant or Moltke, furnished these commanders with brains; of the ingenious reporter who wrote the speeches of Webster; or of the accomplished secretary who dictated the addresses of Thiers. Here, then, is a great field of research for the Harveian scholar.

Yet amidst all those to whom, whether with any grounds or without, the discovery of the circulation of the blood has been assigned, there are a few whose claims merit serious consideration, and who certainly deserve praise for having paved the way for Harvey. Dismissing as preposterous, notwithstanding their frequent reiteration, the stories told of Sarpi and Father Paul, the first who seems to have come near to the truth is the Spaniard Servetus. The life of this extraordinary person is stranger than anything in fiction. A young man of good family, educated at Saragossa, and destined for the church; abandoning this object for the family occupation of the law; relinquishing this to become private secretary to the confessor of the great Emperor Charles V. at the Diet of Augsburg; parting with the devout clergyman with a leaven of unbelief working in his soul; writing when still in his youth a work on the Trinity, which stirred Switzerland and half of Germany, and was pronounced by Luther a fearfully wicked book; known in different countries by different names, and supposed in each to be a different person; correcter of classics for the press, compiler of sumptuous

works on geography; composing a very inoffensive and orthodox treatise on syrups with the same ease with which he wrote his aggressive and terribly unorthodox theological speculations; fellow-student of Vesalius and almost as accomplished an anatomist, astrologer rebuked by the Medical Faculty; restless wanderer, trusted physician to a steady community for a long term of years; the friend of Calvin, finally his victim; tolerant of differences of opinion and belief, but burnt at the stake as a martyr for his own;—his figure stands out in history as one of the most striking of the sixteenth century. The chief announcement he made of the circulation of the blood is found in the book published in 1553, which was consigned to the flames with him, and of which only two copies are known to have escaped. The "*Christianismi Restitutio*" is one of those half theological, half physiological treatises, in which this versatile child of genius delighted. It contains a singular passage referring to the vital spirit which has its origin in the left ventricle, the lungs particularly aiding in its generation. The right ventricle passes the blood to the left, not, as supposed, at least not in any quantity, through the septum, but through the lungs, where it is elaborated, becomes of crimson color, is transfused into the pulmonary veins, mixing there with the inspired air. The blood is not sent to the lungs simply to nourish them, but to be there altered, and is brought back to the heart by the dilatation of this organ.

Here, then, united with error, is a recognition of the

pulmonary circulation. But as regards the impermeability of the septum, Vesalius had anticipated Servetus.

Six years after his death the skilled anatomist Realduus Columbus published in his "*De Re Anatomica*" a clearer and much more accurate account of the pulmonary circulation. He thinks that not merely most, but all of the blood from the right side of the heart passes through the lungs. And it gets from the left side of the heart into the aorta, and then is transmitted to various parts of the body. Yet the veins arise in the liver, and nutritive matter is changed there into blood. There is no idea of a continuous flow of blood; the heart is not even a muscle.

Cæsalpinus, for whom Flourens* in his trenchant criticism claims that he was the true forerunner of Harvey, adopted the views of Columbus, more forcibly perhaps setting them forth. He notices that in tying the arm in venesection the veins swell on the side away from the heart. He pens a sentence from which we learn that the blood is conducted to the heart by the veins, is there made perfect, and is then distributed by the arteries over the body. He describes not inaccurately the pulmonary circulation. How near to the discovery is all this, how apparently the discovery! It is only when we read other passages that the whole matter wears a different aspect. He evidently thinks that there are two distinct kinds of blood; that in the veins is formed for them, and flows to

* *Histoire de la Découverte de la Circulation du Sang.*

and fro in them; the heart and arteries distend by an effervescence of the spirit. There is communication between the arteries and veins, but it is only during sleep. The circulation was, after all, not discovered.*

Indeed, while we detect evidences in those whose claims are alone worth discussing of a knowledge of the lesser or pulmonary circulation,—and when we turn to the pages of Harvey, we discern how much more clearly and accurately he described even this,—we nowhere find that the greater or systemic circulation was understood. No man before Harvey knew that there was but one kind of blood, which is kept in continual motion. No man had discerned that a drop of blood starting from the left side of the heart will return to it, having made the circuit with amazing rapidity.

We have been discussing the claims of the medical predecessors of Harvey, but we must not neglect another

* The question of the claims of Cæsalpinus has been recently reargued with a good deal of feeling, as well as learning. He has found a powerful and eloquent advocate in his countryman Ceradini (*"La Scoperta della Circolazione del Sangue,"* Milano, 1876, and *"Difesa della mea Memoria,"* Genova, 1877); a severe critic in Tollin (*"Sammlung Physiologische Abhandlungen, erste Reihe,"* Jena, 1876), who most learnedly and somewhat bitterly defends Servetus's claims against those of Cæsalpinus. Gamgee (in various papers in the *"Lancet"* for 1876 and 1877) has given us a fair judicial summing up of the matter. Huxley (*"Fortnightly Review,"* February, 1878), who has been analyzing the claims of the different investigators with his accustomed keenness, rejects that of Cæsalpinus altogether. A well-written article in the *"Edinburgh Review,"* January, 1878, seems to me to concede too much to him.

authority who is cited,—that of the greatest of poets. Shakespeare is indeed credited by some, on the strength of some striking passages, with having divined the circulation of the blood, while others explain them on the supposition of his having derived his information from Harvey. Neither statement is true. Yet the passages are most remarkable.

“ You are my true and honorable wife ;
As dear to me as are the ruddy drops
That visit my sad heart,”

is the exquisite language in which Brutus addresses Portia.
Again, in “ Measure for Measure,” Act II., Scene 4,

“ Why doth my blood thus muster to my heart ?”

and Act I., Scene 4,

“ Lord Angelo is precise ;
Stands at a guard with envy ; scarce confesses
That his blood flows,”

in “ Merchant of Venice,” Act III., Scene 2, Bassanio’s speech,

“ I freely told you all the wealth I had
Ran in my veins, I was a gentleman,”

in “ Cymbeline,” Act III., Scene 3,

“ The princely blood flows even then in his cheek,”

in the “ Sonnets,”

“ now Nature bankrupt is,
Beggard of blood to blush through lively veins,”

and in the “ Rape of Lucrece,”

“ The more she saw the blood his cheek replenish.”

In fact, the whole of *Lucrece* is full of allusions, and many other passages from the plays might be cited. Now, if these passages mean what they are sometimes held to mean, Shakespeare was aware of the circulation; moreover, he could not have obtained the information from Harvey, even supposing them to have been acquainted, of which there is no evidence. He could not have obtained the information, because the verses were written long before Harvey possessed it. If, therefore, we accept them literally, they seem to prove that Shakespeare understood the circulation of the blood in advance of Harvey. Yet this is only in appearance; the lines, even if literally construed, bear a very different interpretation. They simply show that Shakespeare was cognizant of the pulmonary circulation, at that time partially comprehended, and that he referred to the presumed movement of blood in the veins, also known to the science of the day. But there are no passages which can be twisted to make it clear that he knew anything of the real circulation,—of the circuit of the blood. They certainly, however, prove him to have been as far-seeing a physiologist as any of his age, with the single exception of Harvey.*

* As the dates of the passages alluded to are of importance in connection with this inquiry, it may not be without interest to examine into them. Julius Cæsar, Collier tells us, was written before 1603; Halliwell, in his Introduction to the play, adduces evidence that it was written in or before 1601; Malone fixes the date at 1607. The earlier dates, most likely the correct ones, were in advance of, or about, the time Harvey returned from

tion, as he understood it, which it needed further research—some are to this day not definitively solved—to establish or correct, such as the exact forces at work in the return of the blood-stream through the veins; yet it is amazing how nearly complete was the recognition of the truth his insight had discerned. It does not detract from his merit that the truth was not the whole truth, and that there were so many foreshadowings of it. It is with discovery as when standing in a mist which masks a splendid view. The dense cloud shrouds the mountain-tops and

meaning of pore as we understand it; it is translated by some of the best scholars as pore, or porosity in the modern sense. For instance, in Cousin's translation of Plato's *Meno*, p. 156, we find "et qu'elles ont des pores [*πόροις*] dans lesquels et au travers desquels passent ces écoulements . . . et que certains écoulements sont proportionnés à certains pores;" and Bussemaker and Daremberg sum up a passage (vol. i. p. 457 of their translation) of Oribasius, in which the word *πόρος* repeatedly happens, as "différence de la voix suivant la porosité des chairs."

Porositas is scarcely to be called a Latin word. It is not even to be found in the great glossary of Du Fresne du Cange. It was used by Harvey and his cotemporaries, and his immediate predecessors, as it was current in the English, French, and Italian languages; and in these languages it was then employed in precisely the same sense as it is now employed. Bacon and More so used it, Milton uses porous with the same general meaning, and Littré quotes Paré's application of porosity in a sentence which would be exactly the same in modern French. Certainly Harvey's cotemporaries did not understand him as meaning anything else than we do; for one of his most ardent admirers, Charleton, published in 1658 a treatise (quoted by Sprengel, "*Geschichte der Arzneikunde*"), in which he mentions that the passage of the blood from the arteries to the veins had not been demonstrated, and that the blood first most likely

conceals the valley below. A streak of sunshine fitfully illuminates a ridge, a puff of wind brings to view a winding stream; but the mist deepens again, and the outlines fade away in it. Suddenly the sun penetrates, the mist melts away, the mountain-peaks stand out boldly, a gorgeous landscape is revealed; yet all is not visible, for in the distance a cloud resting half-way up a hill still conceals a part of the charming scene.

Of the extraordinary value of the discovery of the circulation of the blood there can be no question. There have been discoveries in Medicine which have more im-

passed into the flesh. Harvey himself, too, has told us what significance to attach to his words, when he writes in his letter to Slegel not "to inquire what a word properly signifies, as how it is commonly understood."

Now, as regards the passage in the last chapter of the treatise on the Motion of the Heart and Blood, in which Harvey states that the ultimate capillary divisions of the arteries appear like veins, and this not merely in constitution but in function, it is at first sight very difficult to explain. Yet I think he means by *divisiones capillares arteriosæ* simply the minuter arteries, for he goes on to say that they may pulsate in fevers, in inflammatory tumors, and in the fingers. On the whole, then, I am reluctantly forced to believe that the generally held opinion of Harvey not having understood the capillary circulation is correct. There is, however, a point which the inquiry into the whole matter has corrected. Harvey thought that in certain parts of the body the arteries opened directly into the veins; he mentions, however, only three; and if, as they certainly convey the impression, the editors of the London College of Physicians' Edition have sanctioned the inference that Harvey believed this kind of anastomosis to be the common termination of the arteries, the injustice done him will be remedied by the better knowledge brought about through Dr. Forbes's searching criticism.

mediately benefited the human race. Vaccination was one; the introduction of anæsthetics another. But there has been no discovery of which both the immediate and the remote consequences have been more striking. Without it there could be no such thing as scientific medicine; the medicine of to-day would be an impossibility. Leaving out the mere anatomical and physiological bearings, where would our knowledge of diseases of the heart be? Where our recognition of the wonderful process by which clots are wafted about to various parts of the body to produce symptoms to which acquaintance with the circulation of the blood alone supplies the key? How many remedies do we prescribe without taking into account how they are to get into the blood and reach to distant parts? Who would have conceived of stilling pain with the hypodermic syringe, or of transfusion of blood? Moreover, would the ligature have been so universally and understandingly adopted? What surgeon would have thought of cutting off the blood-supply and curing an aneurism by tying the vessel which feeds it? And there are discoveries rendered possible, and consequences to come which no eye that cannot penetrate the future can foresee.

Harvey made other discoveries than that of the circulation of the blood. "Our Harvey rather seems as though discovery were natural to him, a thing of ease and of course, a matter of ordinary business," says Ent, in high-flown language, in his "Epistle Dedicatory;" yet it was true. Notwithstanding the imperfect, totally inadequate

means at his command, without microscope, with only a little hand-glass, he attempted to solve one of the obscurest questions in biology,—that of generation. He was obliged to become involved in a mire of speculation, in which his love for Aristotle plunged him still deeper; he erred in many of his facts and conclusions, nevertheless he anticipated all recent observers in the great doctrine he enunciated of "*omne vivum ex ovo*."* Even in minor matters did he show the ingenuity of the discoverer. He first suggested that there were small tubuli in the Pyramids, sufficient to let out the foul air and to bring in the fresh, and a laborious German has, within a few years, found these air-holes.†

Harvey has yet other claims to greatness, claims which have not been recognized as they ought to be. He freed us from trammels of authority and tradition. He who loved the ancients, and constantly showed his admiration of the manner in which they overcame difficulties, yet wrote in his second letter to Riolan words the effect of which is felt to this day, "That facts cognizable by the senses wait upon no opinions, and that the works of Nature bow to no antiquity; for indeed there is nothing either more ancient or of higher authority than Nature." And in the method which he employed in his search into Nature, he has left that of which the impress is seen in the

* The claims of Harvey and the genius displayed in the inquiry "*De Generatione*" have been admirably examined in the Harveian Oration of Dr. Arthur Farre, 1871.

† Von Pettenkoffer, quoted by Rolleston, Harveian Oration, 1873.

best physiological and clinical work of our time. He made a discovery, chiefly by the inductive process, before Bacon wrote about it, and in our profession at least the mind of investigators has been more moulded by him than by anything Bacon suggested.

Harvey estimated his famous patient much for his wit and style, "but would not allow him to be a great philosopher." Aubrey mentions, "Said he to me, He writes like a Lord Chancellor." This judgment is the judgment of many workers in science both in the past and present. They cannot forgive him his almost utter ignorance of the science of his day, his arrogance towards many investigators, his absurd experiments. But the judgment is too harsh. Bacon's influence has been felt in too many directions. He did not know science, but he thought sciences.

Harvey's merits, then, are many; and his life is the most typical one of an illustrious physician. As he was, I think, beyond all doubt, the greatest of the great physicians of comparatively modern times, perhaps of any time, he illustrates in his person the finest traits of the intellect and heart of the profession. Not content with the known, but with an eye ever eager to read the unknown; reverencing the past only in so far as it may help to enlighten the future; patient of search, keen of thought, ingenious of surmise, but holding surmise only as the glimmer of a truth to be ascertained; bold of inference, yet trying that inference by every test alike of thought and experiment, before it is proclaimed law; consummate

in reasoning and in the art of clear expression,—we have in his mind the best example of the scientific mind. And in the quality of candor, of charity, of perfect benevolence, in love never waning for those dependent on or associated with him, in serenity, in self-sacrifice, and in untiring devotion, he nobly upheld the character long generations of good men had given to his calling, when most perfect.

But we who are standing at the beginning of the fourth century of the birth of him from whom Modern Medicine takes its being; we who connect a glorious past with a hopeful future; we who, whether old and weary in the service or young and ardent to enter it, are all pressing forward towards the same goal,—we have a sacred duty made incumbent by him and those like him. An ancestry full of imperishable example tells us what to do. It directs us to seek in a soil of marvellous richness for those gems through which human welfare and happiness are promoted. It pleads with us to strive that we make this time one in which every step in knowledge, every step in discovery, is but the step towards wider truth. It bids us so to work that increasing power will still leave us humbly searching for that which the Great Creator has planned as inexhaustible. Away, then, sloth, away indifference! A future splendid in its promise, awful in its responsibilities, beckons us on. And unless we prove degenerate sons, we must follow the lead of the great and good that have made this future possible.



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